ICA PreConference: What is an Organization? Materiality, Agency and Discourse, Montréal, May 21-22, 2008

Mylene HARDY
CRAIC Research Center, Aix IEP, Aix-Marseille 3 University, France
UFR IDIST, Lille 3 University, France
mylene.hardy@univ-lille3.fr

Serge AGOSTINELLI
LSIS Laboratory, Aix-Marseille 3 University, France
serge.agostinelli@lsis.org

Organization as a multi-dimensional network of communicative actants mediated and organized by an organizing network of cultural rules

Abstract:

This paper aims to provide a complementary perspective to the Montreal School's conceptual framework on the organizing properties of communication. The network metaphor is used to address two issues of this theory: how to link entities with variable ontologies together and how to explain that entities are objects (inherent ontology) and mediators (relational ontology) at the same time? Networks are considered both as material structures (directed graphs seen as topological objects) and as abstracted ones (matrixes). Complex networks display structural properties when they emerge as structures. However, the emergence of structure is only considered as a realization of one of the virtual states and possible patterns of a meta-network made up of at least three networks on several dimensions: a material network of actants, a cognitive network and a cultural network of rules. The latter network is linked to human entities only. Cultural rules are seen as habitus, i.e. kinds of force fields that guide but do not determine action. Human agency is constrained by cultural rules so that human beings are able to reproduce social systems. Agency is also seen as continuous modification and displacement. It modifies the structure of the network of actants and that of the network of rules. The network of actants makes the network of rules evolve through feedback loops. The network of rules generates calculations in the cognitive network. Sensemaking results from the continuous process of reproduction-modification of the cognitive structure.

Keywords : network – emergence – culture – rules – agency

Introduction

Concepts derived from complexity theory are widely used in organization theory. However, research on complexity in organization can be no more than metaphorical (Stacey *et al.*, 2000). Metaphors are commonly found in organization theory. They are powerful tools that highlight particular ways of organizational functioning (Morgan, 1980). There are several kinds of metaphors. Whereas metaphors only provide conceptual framework and vocabulary in new situations, analogy operationalizes the metaphorical conceptual framework (Tsoukas, 1993). Inter-disciplinary analogy is the best way to generate new scientific knowledge (Tsoukas, 1993). Transferring complexity concepts from physics to social sciences is an interesting choice yet potentially dangerous if we forget human beings in the process (Miller, 1998). Stacey (2001) recommends shifting from system thinking to complex thinking, because the cybernetic approach does not provide an analogy for human action, but interaction-based complexity models do. Therefore, a theoretical framework based on complexity could support Cooren's "interactorial" approach (Cooren, 2000). Most of the complexity-related perspectives in social science have a realistic ontological principle and are based on evolutionary theories (Byrne, 1998). Since this paper questions interactional issues rather than ontological issues of entities, its approach is based on the realist assumption as well. This does not mean, however, that it considers organization as a reified entity. Research routinely views organizations as complex adaptive systems (CAS) (Stacey *et al*., 2000; Morel and Ramanujam, 1999). We prefer to emphasize the complex network metaphor and to define complexity as "a set of presuppositions that shift science away from, or beyond, the Newtonian, deterministic, reductionist perspectives" (Luhman and Boje, 2001). The first reason is that former research has already conducted in-depth analysis on the general functioning of organization as CAS. The second reason is that the network metaphor seems more useful to examine the problem of materiality. Networks are not only powerful

metaphors of interlinked entities, but also powerful mathematical tools. They can be represented in a physical or a visual way, as maps of relationships, or in an abstract way, as matrixes. As physical structures, networks are the best example of a new trend in physics: the geometrization of space. A fundamental characteristic of physical objects is that they all have a specific shape (Boi, 1998; Lochak, 1994). Space and shape should not be understood in a Newtonian way. Shape is not given, but is constructed through a dynamical process. New directions of research in physics have emphasized the curvilinear form of space, and some research advances that relativity theory is scalar, that is, that space and time are fractals. It seems that geometry, and in particular topology, is helpful for studying physical objects, precisely because it relates the material and the abstract worlds. At the metaphorical level, geometry is interesting for its visual properties. "More important than the novelty of its knowledge claims in mathematics and physics, the wider appeal of complexity science stems from its contribution to the emergence of a new imagery in terms of which the world may be understood" (Tsoukas and Hatch, 2001: 996; Prigogine, 1997). As matrixes, networks are very powerful, because matrixes can be combined and reshuffled (Scott, 1996). Networks or matrixes are not limited by materiality in space and time. First, they are able to integrate both physical objects and immaterial ones, like concepts. Second, they may go beyond the unique dimension of materiality; they allow us to imagine the multi-dimensionality of space and time. Therefore, the network metaphor should be a powerful tool to address two recurring issues identified in the Montreal School's theory (Cooren, Taylor and Van Every, 2006; Taylor and Van Every, 2000; Taylor *et al.*, 1996): (1) how entities with variable ontologies are able to interact; and (2) how some of the entities can be, at the same time, material objects (inherent ontology) and mediators (actors-networks whose ontology is relational).

Contrary to Callon and Latour, Cooren (2000) does not use the term "network" because of its flat, non hierarchical aspect. However, this paper emphasizes the multi-dimensional aspect of

networks in complexity theory and therefore the usefulness of the network metaphor for describing the organizing process because of its capacity to go beyond local and global dimensions (Latour, 1991). In his book on human communication theories, Littlejohn (2003) has put together in a chapter on "Communication and organizational networks" structurationist theories such as Taylor's, as well as cultural theories, arguing that the network metaphor fits best with these theories, since "network theory is based on individual interactions among people, which build up into a macrostructure" (Littlejohn, 2003: 300). As Littlejohn pointed out, the cultural approach is also a way to reassemble agency and structure, since "culture systems may, on the one hand, be considered as products of action, on the other hand as conditioning elements for further action" (Kroeber and Kluckhohn, 1952: 181).

Like Callon and Latour (Latour, 1996), researchers of the Montreal School have acknowledged the agency capacity of objects. But in their attempt to create an "interactorial" theory (Cooren, 2000), they have not clearly explained the differences between the agency capacity of humans and objects. If one acknowledges the centrality of culture in the human world, one must acknowledge that human entities have a particular role in the network. This paper, through the metaphor of multi-dimensional networks, aims to introduce culture into the Montreal School's theory. First, two opposite views of networks, a post-positivist one, and a post-modernist one, are examined. A complex approach of the concept of network is then advanced to explain how organizational structure emerges from agency. The last part of the paper examines the role of culture in organizational communication and looks at culture itself as a network of rules co-evolving with the organizational network of actants.

1. Organizational network

After having successfully explained the physical world, the network perspective has been used to explain a wide range of phenomena (Watts, 2004; Barabasi, 2002). In social science,

the network perspective focuses on relationships between actors, which may be individuals or organizations. The difference between the network perspective and the traditional perspective on organizations is its "focus on relations rather than attributes, on structured patterns of interaction rather than isolated individual actors" (Brass *et al.*, 2004: 795). The network analysis has been accepted as a way (and a tool) to study communication and other relationship structures within the organization (Stevenson and Greenberg, 2000). The network approach has also been used by sociologists as a way to characterize forms of organizations different from the organizational forms described by economic theory (Poldony and Page, 1998; Powell, 1990).

While network analysis aims to provide tools to study and predict organizational behavior, a non-reductionist view of networks can be found in actor-network theory. In their anthropological study of science, Callon and Latour (2006) described the network as made up of the circulating flows of inscriptions that are translated from one actor to another. Latour emphasizes the non-reality of the network. "It is only a tool to help describe something, not what is being described" (Latour, 2005: 131).

At first glance, there seems to be an unbridgeable gap between how these two theories conceive of the concept of network. Nevertheless, this paper aims to show that a dialogue is possible (cf. also Robichaud, 2006).

1.1. Complex networks in complexity science

Two streams of thought dominate complexity theory. The first has been named "reductionist complexity science" (Richardson and Cilliers, 2001: 5). It consists of studies conducted in physics and computer science on complex phenomena. Although they study the non-linearity of phenomena, they assume that it is a deterministic non-linearity. Another assumption is based on the generalization of their findings. Although complex systems do not obey

universal laws, they still obey local laws. That is the reason why Morçöl (2001) highlighted that complexity science is not post-modernist, but post-positivist. The second stream is a philosophical stream that tries to develop complexity as an approach (Morin, 1977), or considers complexity as the post-modern development of science (Richardson, Cilliers and Lissack, 2001). To be able to use the network metaphor, one must be aware of its link to the first stream of thought, that is, to be aware of the post-positivist assumptions lying behind the concept. Why use such a metaphor? Firstly, every complex phenomenon can be described by directed graphs (nodes linked by directed relationships). That is to say, networks are a good dynamic model for describing complex systems (Green, 2000; Seeley, 2000). Secondly, dynamic networks are complex, non-linear and self-organized systems that display the five properties of emergence (Goldstein, 1999 : 50): (1) radical novelty ("features of emergents are neither predictable nor deductible from lower or micro-level components"); (2) coherence ("emergents appear as integrated wholes that tend to maintain some sense of identity over time"); (3) macro level principles ("the locus of emergent phenomena occurs at a global or macro level"); (4) dynamical properties ("emergent phenomena arise as a complex system evolves over time"); (5) ostensive characteristics ("emergents are recognized by showing themselves"). Thirdly, networks have already been used in communication studies as a tool to study communication patterns in organizations (Monge and Contractor, 2001). Networks in network analysis are often static descriptions of existing patterns of relationships between people in an organization. Only a few studies have been conducted on the problem of emergence of such networks, that is, their structuration and their evolution. Another problem is that social networks must be simple, small and complete (with clear boundaries) in order to be studied (Carley, 2006). Carley (2003) has responded to these issues by modeling social networks according to three principles: (1) Using a meta-matrix: in her study of terrorist networks, Carley designed a multi-dimensional network, composed of ten inter-linked

networks, so that relationships in a given network implies relationships in another network. Networks' nodes are not only people, but also abstract entities. Nodes are variables and can evolve over time. Therefore, change in a network will lead to change in other networks. Given its complexity, the system will display emergent properties. New measures will be available at a higher level, since a set of entities can be linked in the meta-matrix to compose a new form of metrics. (2) The second principle is to introduce probability in relationships between entities based on various techniques, such as cognitive inferences. (3) Dynamic network analysis is based on multi-agents that evolve themselves. It can be said that there is a co-evolution between the agents and the structure. At the same time, if each network is a structure, it co-evolves with other networks, leading to cascading changes in each network and agent. Such a dynamic model has been thought to "facilitate reasoning about real groups as complex dynamic systems" (Carley, 2006: 1). In the complexity literature, social systems have not been distinguished from biological or even mechanical systems. Rather they are considered to be a higher level in a continuum of systems complexity. For instance, Boulding (1956) has classified systems on nine levels, according to their complexity. Each level integrates the characteristics of the lower levels. For instance, simple dynamic systems have pre-determined movements, like clockwork. At the top of the hierarchy, socio-cultural systems are above human systems, themselves higher than animal systems, etc. In such a view, the micro-macro link is seen as a fractal link, where identical shapes are repeated throughout the levels. Nevertheless, Carley does not use the biological metaphor. She rather considers social systems from a physical and mathematical viewpoint, where networks are designed as a set of entities linked by a set of relations, that is to say, matrixes. Matrixes are mathematical expression of networks. The aim of dynamic network analysis in complexity science is to study the emergence of structure on a macro level from agency (action displayed by modeled agents) on the micro level, and to observe how the structure constrains agents' future

interaction. Thus, Carley's dynamic network analysis can be seen in the same light as complexity science, that is, as an "order creation science" (McKelvey, 2001).

1.2. Complex networks in the actor-network theory (ANT)

Despite the use of the same word, the concept of network in actor-network theory (ANT) is not only radically different from the one seen above it is also in contradiction with it. For Latour (2005), actors are not entities, but translators of other networks. Therefore, "the tricky word 'network' [is] being defined (…) as what is traced by those translations in the scholars' accounts" (Latour, 2005: 109). Some explanations are needed here.

In ANT, actors are not named "actors" because of their human characteristics. Actors are in fact actants, that is, any material or conceptual "actor". However, there are named "actors" to emphasize their agency capacity. An actor is the external locus of action: it is not only an actor, but an actor-network. The actor-network concept has been chosen to express the complexity of the actor: the actor is not an entity, but a crossing point, or, using Latour's word, a "mediator". "If an actor is said to be an actor-network, it is first of all to underline that it represents the major source of uncertainty about the origin of action" (Latour, 2005: 46). Actors in ANT have an ambiguous and relational ontology. ANT has borrowed the concept of "actants" from narrative theories, precisely because, Latour says, "since they deal with fiction, literary theorists have been much freer in their enquiries about figuration that any social scientist" (Latour, 2005: 54). Latour has not only borrowed from Greimas. ANT is influenced by Bakhtin's dialogism and the concept of intertextuality found in Russian-French semiotics. The notion of intertextuality was introduced by Kristeva, who combined Bakhtin's idea of dialogism (several voices existing in a single utterance) and Barthes' semiotic analysis of texts, in order to create the concept of a dialogue between several texts within a text (Kristeva, 2002). This influence can be found in some of the theories of Latour's inheritors. For instance,

Boje (2007) acknowledges his theoretical debt to Bakhtin and Latour. In ANT, the actor is the mediator of other voices, other actions. However, it is not an intermediary, that is, a simple medium crossed by voices. Actions are concentrated within the actor, because it is a crossing point. "Action is borrowed, distributed, suggested, influenced, dominated, betrayed, translated" (Latour, 2005: 46). Actions and voices (textual voices) are almost the same. Agostinelli (2003) uses the concept of communicational artifacts to describe such actors-networks. Communicational artifacts are artifactual systems and not objects. Communication is an artifactual process, "where individual and collective exchanges are constituted depending on human resources and communicational situations linked to each other" (Agostinelli, 2003). The ontological question of the actor-network complexity remains. The answer lies in the difference between intermediaries and mediators in ANT.

> An *intermediary*, in my vocabulary, is what transports meaning or force without transformation: defining its inputs is enough to define its outputs. For all practical purposes, an intermediary can be taken not only as a black box, but also as a block box counting for one, even if it internally made of many parts. *Mediators*, on the other hand, cannot be counted as just one; they might count for one, for nothing, for several, or for infinity. Their input is never a good predictor of their output; their specificity has to be taken into account every time. Mediators transform, translate, distort, and modify the meaning or the elements they are supposed to carry. No matter how complicated an intermediary is, it may, for all practical purposes, count for just one – or even for nothing at all because it can be easily forgotten. No matter how apparently simple a mediator may look, it may become complex; it may lead in multiple directions which will modify all the contradictory accounts attributed to its role.
> (Latour, 2005: 39)

Latour's approach is descended from phenomenology and post-modernism. In the ANT viewpoint, complexity, complication or even non-existence of the actor-network are only attributes given by the observer.

However, some questions can be raised about this viewpoint. On the one hand, Latour's description of mediators emphasizes the possibility that the "actor" phenomenon may occur ("it may", "it might"). The probability of actors' emergence seems to reside only in the observers' eyes. On the other hand, actors seem to have some materiality in Latour's account.

The problem may lie in the meaning we give to the concept of ontology. What does ontological complexity mean when there is relativity of space and time? This could be the

point outlined by the narrative theories. According to Boje (2007: 1): "Emergence is defined as absolute novelty, spontaneity, and improvisation, without past/future. Dialogism is defined as different voices, styles, and ideas expressing a plurality of logics in different ways, but not always in same place and time". Latour emphasizes above all the space dimension: "action is *dislocated*" (Latour, 2005: 46). Local needs to be globalized, and global, localized. In other words, voices, i.e. communicational actions, occur simultaneously in place and time based on how the mediators account for them.

According to Prigogine's principle, chaos self-organizes when elements locally pump the outside disorder into their own organizing system to continue organizing. This is the principle of the emergence of order from noise described above. In their role of "concentrators", mediators can be considered to be the organizers of the complex flows of phenomena. They represent the self-organization point (i.e. strange attractors, cf. Kauffman, 1995). Latour may object that there is neither line nor point in ANT, since even points are not material. This paper argues that Latour's concept of materiality is embedded in a Newtonian notion of materiality, which states the reality of space and time. However, space and time are not anymore seen as "real" in the new science. Heisenberg's uncertainty principle states that the calculation of a particle's position makes the calculation of its momentum uncertain, and *vice versa*. Quantum physics is based on probability calculations and on the observer's disturbance of the system observed. Newtonian materiality is questioned in such a science, whereas another perspective on materiality is proposed, based on the symmetrical properties of the "real" world (MacArthur *et al.*, 2007; Lambert, 1999; Mandelbrot, 1984)[1]. Latour also seems to attribute some materiality to the mediating point for a short time period as well.

> For ANT, (…) the definition of the term [social] is different: it doesn't designate a domain of reality or some particular item, but rather is the name of a movement, a displacement, a transformation, a translation, an enrollment. It is an association between entities which are in no way recognizable as being social in the

[1] Symmetry of the world is the reason why we suggest that the organizational network emerges from a "virtual" meta-network (of disorder). However, the virtual meta-network, or possibility space, does not consist of addable parts (cf. Lissack and Roos, 2007).

> ordinary manner, *except during the brief moment when they are reshuffled together*. (…) Thus, social, for ANT, is the name of a type of momentary association which is characterized by the way it gathers together into new shapes.
> (Latour, 2005: 64-65; emphasis by the authors)

The disturbance caused by the observer's action that reshuffles elements together could be compared to the disturbance made by observation in quantum physics. Therefore, the problem is not the materiality of the point: the point exists (in space and time) because of the relationship constructed between the observer and the object observed (cf. also note 4). The question is rather how to give an account of such material characteristics.

2. Organization between absence and presence

2.1. Action as the emergence of presence

The question of the materiality of the actor-network could be summed up as follows: is the actor-network an entity or agency in and of itself? This paper follows in the path of Cooren (2006), who proposes an "agency turn". Taylor and Van Every (2000: 3) have advanced a theory of the organization where "organizations can be both local (systemic) and global (structured), bounded by constraints of space and time and yet transcending them". For Cooren (2006: 82), "action in general (and organizational action in particular) should be considered a hybrid phenomenon; that is, a phenomenon that tends to mobilize the participation of entities with variable ontologies (material, discursive, human, nonhuman)". Whereas in Latour's theory, the ontological status of the actor-network may sometimes be denied, Cooren recognizes that there is the possibility to give them a presence. The sign makes the absence present. *Teleaction*, i.e. acting on behalf (of something), is also a form of *representation*, i.e. making present. Action is therefore seen as a sort of "presentification" (Cooren, 2006). Mediators represent the derridean *différance*: when they appear, they somehow erase the other possibilities of voices and actions. They emerge from the latent disorder precisely because disorder is only the possibility of a material presence, that is, the

probability that an entity emerges at that point in space and time. In other words, the possibility of order (emergence and organization) already exists in disorder[2].

Whereas networks in artificial intelligence have their own boundaries, networks in society do not. There is only one meta-network whose links will appear and disappear with time. Only the structuration of those links will make structures, that is, sub-networks, emerge. However, social networks do not disaggregate like random networks. Social networks are complex adaptative networks whose functioning is similar to dissipative structures (Harvey and Reed, 1996): they self-organize and are characterized by a homeostatic quality. According to Kauffman (1995), such networks have a kind of stable core and changing elements at the periphery, so that they are able to maintain their structure in most cases. Only sometimes is their structure totally renewed because of great changes. Consequently, it can be said that communications occur within almost stable organizations.

However, here, entities are not "beings", but actors-networks, that is, organizations of actions. For Cooren, an agent is that "which acts (…), which has an effect on our behavior", action is "what is shared between actors", so that action is never isolated but embedded in chains of nested actions (Cooren, Taylor and Van Every, 2006: 9;11). Since actants are actors-networks, they embody this chain of actions, or in others words, networks of actions.

2.2. A communicative meta-network

Social organization is an emergent property of a structured system of communicating individuals (Corman *et al*., 2002). In a discursive approach, agents are what act communicatively. The meaning of the organizational framework (or text) emerges from the intertwined communicative acts that organize the conversational disorder. But agents themselves can be considered as actors-networks: they are themselves communicative

[2] In fuzzy logic, both probability and possibility measures reflect rational knowledge. Mathematical theories are only models, that is, necessarily incomplete and reductionist accounts of the world. However, they can help social scientists to look at the object of inquiry from another interesting perspective.

networks, or artifactual systems, not only in the sense that they themselves re-present, but also in the sense that they are constituted as individual entities only because (or after) they belong to the social.

Carley's meta-matrix model could be used to represent the double characteristic of agents, both unity and actors-networks. The social system is seen as a meta-network made up of several networks in several dimensions (see also Byrne, 1998). However, these networks are not separate parts of the meta-network: like every complex system, the meta-network emerges from interactions between its parts (single elements or sets of elements, i.e., networks). Each network also emerges from interactions. A point needs to be clarified: networks are not Russian dolls: they are not nested one within another. There is a hierarchy of emergence of structure, but there is no small network within a bigger one and so on. Interactions between networks are multidimensional, that is, there are interactions between some entities at any level. Here, networks are the topological expression of a matrix. A matrix is a mathematical way to express relations between two sets of elements. In a matrix, relations between the elements can be binary variables (1 if the relation exists or occurs, 0 if not) or any other kind of quantitative variables. Thus, a network is the structure composed of the links between these elements in a point of time. Moreover, networks can be directed networks. That is to say, the mathematical model displays the direction of the links relating one set of entities to another. Networks' elements can have the variable ontologies proposed by Cooren: human, nonhuman, material and discursive. The meta-network is multidimensional, since there can be networks of human/human, human/non human, material/discursive, discursive/discursive, etc.

2.3. Agency and structure in complex networks' structuration

In Giddens' theory, social structure is a double concept that includes both the patterning of interaction and the continuity of interaction in time. It should be noted that structure does not mean materiality of social systems, but properties of social systems.

> (…) 'structure' refers to 'structural property', or more exactly, to 'structuring property', structuring properties providing the 'binding' of time and space in social systems. I argue that these properties can be understood as rules and resources, recursively implicated in the reproduction of social systems. Structures exist paradigmatically, as an absent set of differences, temporally 'present' only in their instantiation, in the constituting moments of social systems.
> (Giddens, 1979: 64)

Thus, structure is a kind of 'virtual order' of the principles constructing the organization. In this sense, there would be at least two meta-networks. A meta-network of actants, and a meta-network of structuring properties. Organizations are understood as the embodiment of the first kind of network, that is, the network of actants (or agents) linked by agency. For Cooren (2006: 82), an *agent* is "what or who appears to make a difference, whereas *agency* simply means making a difference". For Giddens, the derridean différance has a threefold meaning: "social activity is always constituted in three intersecting moments of difference: temporally, paradigmatically (invoking structure which is present only in its instantiation) and spatially" (Giddens, 1979: 54). Différance can be compared to the verb "différer" in French, which means "to delay". Différance has not only a spatial but also a temporal dimension. "Making a difference" means that the agent acts in relation to other simultaneous actions in space, but also in relation to past actions. According to Watts and Strogatz (1998), real-world networks are neither completely ordered, nor completely random. Materiality emerges in space and time from disorder, and organization evolves thanks to disorder. Therefore, "collective entities are *variable geometry entities* with a mode of being that is never finalized or defined" (Cooren, 2006: 92). Collective entities are the variable geometry meta-network of organization that continuously self-organizes in space and time, that is, that emerges from the other possible dimensions. The three dimensions of difference, time, space and configuration, are necessary for the constitution of the real (Giddens, 1979). There can be three "layers" of networks: (1) disorder: a layer of possibilities that agency occurs; (2) first structuring layer: a layer of conversational actions; and (3) second structuring layer: a layer of organizational structuring. On the first hierarchical level, there is only a probability that agency occurs

between two entities. The first structuring layer is a kind of first granularity layer, where communicative phenomena occur, but where there is no real consistency of space and time, while the second structuring layer binds granularity in space and time: if the communicative links are not repeated, that is, if there are no feedback loops, there will be no organizational emergence. Simon (2005: 469) puts forth that "the grouping of a structure may be defined operationally by some measure of interaction frequency in [the] sociometric matrix". Granularity appears with communication, because communication is mediated by language. Consequently, conversational actions are not disorder, since they structure disorder when they emerge. But they seem to be themselves a form of ephemeral disorder, if compared to the structuring of the organization.

2.4. Linking networks and actors-networks together through topology

To understand how networks unfold in space and time, networks must be seen as topological structures. Topology is the branch of geometry that studies deformation of space through ongoing change. Dynamic networks are the topological expression of the structuration process of collective entities (Moody, McFarland and Bender-deMoll, 2005). In dynamic networks, links can appear, disappear, and even be less or more intense. Complexity science explains the structuration of networks with several structuration rules. One of them is that an already connected node has more chance to attract future links than an unconnected one. The more connected an agent is, the more it will continue to be connected. Consequently, the more agents in a collective communicate with one another, the more the collective will structure, that is, the more the collective will emerge as a system with more evident boundaries. Boundaries between organization and environment are not frontiers, they are the expression of the stability of the links linking entities together in the organization, compared to the ephemeral links connecting and disconnecting the organization's entities with other entities in

the rest of the meta-network. The concept of "flat" networks in ANT can be understood in this sense as well. When structures emerge, it does not mean that they erase the other possibilities or make the rest of the 'environment' become static. The Leviathan is like a monster, with several organs (Callon and Latour, 2006). This is why we are proposing the idea of multi-dimensional networks: meta-networks are at the same time structure and order (when they self-organize), and at the same time only networks of possibilities (disorder). Networks are both hierarchical (hierarchy emerges from self-organization), when they emerge at a point in space and time, and flat, when they are only at the state of possibility of materialization at any point in space and time. The 'flat' network is in reality multi-dimensional, so that the hierarchical network emerges from the first one.

When conversational links are "repeated" over time, organizations self-structure as texts, whereas the 'outside' disorder is still conversational. "Feedback loops act to bring together inter-dependent activity into repeated cycles of actions, that is to say, they form routines" (Campbell-Hunt, 2007: 800). However, repetition does not mean that action is always reproduced in the same way. The process of structuration is both a reproduction process and a modification process (Giddens, 1984). In other words, action is both linked to other actions (constitution of text), and different from them (conversational action). Actions are linked to other actions not only according to the spatial dimension (chains of action involving several entities), but also according the temporal one (repetition of links between two nodes). When actions are "repeated", links are repeated between the nodes, but they also differ: there is a displacement of the link. How to explain such a displacement? Understanding this is impossible if we consider that the organizing phenomenon occurs in one dimension only. That is why this paper advances that the meta-network contains three networks (themselves meta-networks).

3. Rules and agency in the meta-network

3.1. Co-existence of material and abstract networks

In the previous part, we examined the emergence of networks from virtual states. We also explained that networks were the topological expression of abstract matrixes. The same question remains. Are organizations material? How can the structuring process be a material and abstract process at the same time? Harvey and Reed (1996) advance that the two ontologies of social complex systems are possible and recommend accepting both. We advance that the two ontologies (object/actor-network) simultaneously exist in the meta-matrix[3]. The matrix links entities with variable ontologies together. This meta-matrix could consist of three kinds of meta-networks. The first one would be the material network of physical actants, human beings and objects: in this network, links gradually appear or disappear, but are not "displaced". The second network would be the cognitive network. The last one would be an abstract network: the cultural network of rules. The latter network would be linked to human entities only. It would enable human beings to make a difference, to displace action. The network of rules would consist of the force field of possible reproductive actions and displacements, and the cognitive network would generate meaning according to both rules and agency. In fact, there would be a fourth network: the language network, since relations between the three networks are all mediated by language. These networks have no other boundaries than the different ontology of their entities and links: in fact, they all co-exist in the meta-network of social life. Therefore, when an organization emerges in social life, it is not only the material organization that emerges, but the set of entities with variable ontologies which belong to each of the three networks: actants, rules and meaning emerge together and shape the organizational text. Moreover, since matrixes are only combinations of entities and can be reshuffled (Scott, 1996), we can easily imagine that a network is only a network of

[3] The same problem occurs in physics with the wave/particle duality: electrons may be seen as objects in classical theory, but they also obey very different laws in Quantum mechanics (Nicolics, 2008).

another network. There is no real different ontology for entities and links: entities, but also links are themselves networks of entities and links, they are "actors-networks". It follows then concluded that ontology has to be seen as a relational concept. Material entities (human beings and objects) possess a double ontology. They are simultaneously material entities that have emerged in their relation to matter and energy, and also "actors-networks", because they are linked to the abstracted network of rules and meaning[4]. Ontology of the abstracted networks is related to information only. Abstracted entities are pure "actors-networks", since they cannot be understood as unified objects with clear boundaries. Human entities and objects should be distinguished within the material network: they seem to possess the same capacity of difference in agency; but the capacity to make a difference is also related to the power and capacity to do otherwise, that is, the capacity to displace action. In a structuring network, this capacity is related to entities' position in the network.

3.2. The cognitive network

Byrne (1998) has, following Maturana, proposed that social systems should be distinct from mechanical ones, because in social systems the novelty would not come from outside, but from inside the system. According the physical approach of information, information is the novelty 'pumped' from outside by open systems. Information would cause the open system to structure, to order, from the outside disorder, from noise. In this positivist view, information is like energy and matter that are exchanged between entities. Social systems are different because of human cognitive capacity. Information is not transmitted anymore, but constructed through the medium of language, that is, information is sensemaking. We see the cognitive network from the connexionist viewpoint. There is no formal structure in the human brain. Cognition is conducted by the processing of neural networks (Pollack, 1989). In the network,

[4] "In Latour's network perspective, any property of an agent (…) must be described as the result of action, not its source" (Robichaud, 2006: 106). Ontology is relational in narratives.

both entities and links are mediated by language. The mode of calculation is decided according to both descriptive rules and normative rules in the network of rules (see below). Human and cognitive networks are inter-linked (Taylor, 2006; Taylor and Van Every, 2000), since sensemaking is a social process (Weick, 1995; 1979; Berger and Luckman, 1966). Interpretation frameworks of a social group constitute a central element of its culture (Goffman, 1974). Weick (1979) advances that sensemaking is retrospective. In the network metaphor, this idea is represented by directed links from actions to the network of rules, then from the network of rules to the cognitive network. Action is analyzed in a conceptual way in the cognitive network within the framework designed by cultural rules. If interpretation was entirely rule-based, it could not evolve. However, since the network of rules evolves, it produces change in the mode of calculation of the neural network as well. Therefore, actors' "web of beliefs" is "continually reconfigurable" (Tsoukas and Chia, 2002: 575). New conceptual patterns emerge through actors' interactional processes (Taylor, 2006; Taylor and Van Every, 2000). Moreover, the topology (structure) of the network of actants influences the calculations of individuals' cognitive network: cognition is situated and distributed (Hutchins, 1991). Contrary to Stacey (2001), we distinguish rules and mental models. Mental models emerge when there is interaction between the network of (constitutive) rules and the cognitive network. However, the two networks have some common points. Links between the network of cultural rules and the cognitive network are bi-directional: rules are specific semantic and inferential concepts, mediated by the language. This means that rules themselves need to emerge from the calculations of the cognitive network. The material cognitive network and the conceptual network of rules are not only inter-linked, but also co-evolve. As Lissack and Roos (2007), following Gödel, pointed out, the system of rules must be incomplete. In this sense, "making sense is a circular cognitive process" (Lissack and Roos, 2007: 3).

3.3. The cultural network of rules

According to Giddens (1979), the structuring properties (structure) that bind space and time in social systems are rules and resources. He also states that there are three conditions in order for structure to appear as a 'virtual order' of differences. "It implies recognizing the existence of: (a) knowledge – as memory trace – of 'how things are to be done' (said, written), on the part of social actors; (b) social practices organized through the recursive mobilisation of that knowledge; (c) capabilities that the production of those practices presupposes" (Giddens, 1979: 64). This paper advances that a rule-based framework meets these conditions. Rules would form both our representations (constitutive rules) and the theory-in-use (Argyris and Schön, 1978) that guides our actions (normative rules).

Rules bind actions together in a structuring network of actions: the organization.

However, rules of conduct neither 'appear' nor 'exist'. According to Wittgenstein, they are performed only. Rules cannot be distinguished from action (Friedberg, 1993). In other words, in an ordered and organized system of actants, rules do not determine action. They generate action. Bourdieu's concept of habitus describes such rules. Habitus are "structured structures, predisposed to function as structuring structures, that is, as principles that generate and organize practices and representations" (Bourdieu, 1980: 88). Rules do not exist singularly, but rather as a system which generates a "local order" of practices (Friedberg, 1993).

> (a) There is not a singular relation between 'an activity' and 'a rule' (…). Activities or practices are brought into being in the context of overlapping and connected sets of rules, given coherence by their involvement in the constitution of social systems in the movement of time. (b) Rules cannot be exhaustively described or analyzed in terms of their own content, as prescription, prohibition, etc. : precisely because, apart from those circumstances where a relevant lexicon exists, rules and practices only exist in conjunction with one another.
> (Giddens, 1979 : 65)

Imagine that interlinked sets of rules form a network of rules. Giddens' structuration theory is a theory of reproduction-modification of the social system. Rules enable the reproduction of the social system, that is, the stability of the structure in time and space. Therefore, the structuration of the social system is produced by interacting micro-rules (Stacey, 2001).

Nevertheless, since rules form a network linked to social action, the network of rules evolves according to situations (see below).

Two types of rules are often distinguished in linguistics and philosophy of language: the constitutive rules and the regulative rules. The first ones help individuals to assign meaning to a communicative act, whereas the latter ones guide behavior (Searle, 1972; Harris and Cronen, 1979). "Fundamental to a sociolinguistic and ethnographic rules-based paradigm is that rules be seen, not as causal elements accounting for the existence of behavior, but as structural descriptions of the behavioral options inherent in actors' social communication competence, and of the different meanings associated with rule adherence, abrogation, transposition, etc., in a given community" (Sigman, 1980 : 38). Therefore, rules should not be considered as an unified object, but as actors-networks: (1) rules are connected to meaning, that is, the network of rules frames the functioning of the cognitive network; (2) rules are connected to agency, that is, the network of rules frames the network of actants; and (3) rules may be changed, that is, both the cognitive network and the network of actants frame the network of rules. This is the reason why we argue that networks do not overlap like Russian dolls. Like Escher's impossible figures, networks are interlinked, so that what may seem to be the "greatest" network is in fact at the same time at a higher and at a lower level than its subordinates. The only way to solve such a problem is to consider that each network evolves in distinct dimensions, and that they are reunited in a meta-network from where some of their entities and links will emerge at a point in time and space in a common dimension.

Another way to say that rules are actors-networks themselves organized as networks is to consider rules as force fields. According to Bourdieu (1979), systems of habitus are force fields that shape human culture. Systems of habitus guide action in social and symbolic space. Since the cultural network of rules is linked to the cognitive network and to the network of actants, rules form a double framework: a framework of the possible meanings that can be

ascribed to a situation and a framework of possible appropriate actions that can be conducted in such a situation.

3.4. Rules and agency

As force fields, rules do not determine action, but "attract" action. For Sigman (1980), rules are structural descriptions of behavioral options. Consequently, we advance that links between the network of rules and the actions in the network of actants are based on probability. In a given situation, individuals have a high probability to behave according to the options proposed by the cultural set of rules activated for this situation in the cognitive network, and yet individuals may make a completely different choice. The capacity to escape from the force field created by a rule is related to the capacity to make a difference. Giddens (1984) defines power as the capacity to make a difference, precisely as the capacity to modify the causal capacities of other agents. In the network viewpoint, the chance that an individual makes one choice rather than another could be calculated as a probability of choice. The network of rules is a kind of dissipative structure. It may evolve in two ways. The first way is structuration: the more numerous communicational exchanges are the more stable the network of rules is. Consequently, the more precise the rules are, the greater the probability that individuals act according to the rules. The second way is change. Lave (1988) has distinguished the arena and the setting in a given situation. Rules explain only partially how action is conducted. They form the arena of the environment, they create landmarks to bind space and time. Action is also performed according to the setting, that is, the configurative novelty of a situation. To act is to make a difference. Since networks are inter-related, there will be positive feedback loops linking actions in the network of actants and rules in the network of rules. Thus, the network of rules will evolve: sets of rules may be reconfigured, and rules themselves may evolve according to their relation with the cognitive framework. When the frames of meaning given

to a situation evolve in a given group, its cultural rules may evolve as well. Moreover, since rules are actors-networks, they can be discussed. When they are discussed, rules become conscious mental models that can be changed through new calculations of the cognitive network. However, change is limited. Networks of cultural rules are homeostatic. They are able to evolve, but they maintain a frozen core. This may explain how culture is constructed through groups' interactions, and why there are co-existing layers of cultures within an organization, or why individuals may share some cultural traits with colleagues at work in the morning then share another culture with their family members in the evening.

This is the main difference between objects and human beings. Objects are linked to a network of rules as well. But it is not the same network as the human one. Rules in the objects' network of rules determine objects' behavior (and objects' cognitive process). Objects' capacity to "make a difference" is limited: they are able to be mediators, but they do not make sense, that is, they only reiterate, they do not put novelty into the system. The reason is that their network of rules evolves slowly, except if human beings deliberately change its properties. Objects' behavior is not predictable only because they are related to human beings in the meta-network of actants: their own network evolves according to the evolution of the human network. However, their own networks (network of objects and network of objects' rules) are relatively stable. This is because mechanical networks need energy from outside to evolve, whereas social networks are able to evolve from inside (sensemaking).

When they communicate, human actors not only organize their cognition according to coorientation (Taylor, 2006), but also organize their position in the collective (they adjust their position in the network of actants) according to their culture (and organize their culture as well). The organization is seen as a possibility space whose emergence is shaped by sensemaking and language (Lissack and Roos, 2007; Taylor and Van Every, 2000; Weick, 1979). It is clear that in this process, human actors and objects have not the same capacity to

make a difference. Since they are related to the infinite conceptual network, human actors have always the possibility to do otherwise despite the rules. They can redefine their position and role in the network, e.g. they can choose with whom they want to interact. But objects do not: the range of their actions is limited by how human beings have created them. However, objects remain, like human entities, actors-networks, since they are linked to other networks.

Since human sensemaking is organizing (Weick, 1979), culture should be considered as a mediating element between communication (action) and organization (structure). The process of translation lies in the establishment of equivalence between several events or terms that occurs according to a system of values for the exchange between actants (Cooren, 2000). Mental models calculated by the cognitive network form the system of values: culture distributes the values of equivalence for symbols and signs that "stand for" and "count as". Values and orders of worth (Boltanski and Thévenot, 1991) are related to groups' culture. Through the way in which it arranges the objects, culture also defines the "frame" of our interactions and "channels" the network, because it is culture that gives a particular role of iterability to communicational artifacts: a same physical object can have different roles of iterability regarding to the situations framed by cultural rules. Actors-networks are "black boxes" that do not need to be re-negotiated each time as long as the cultural rules linking their elements together exist. But if those rules are modified, so are the values of equivalence, and so is the way in which translation is made between entities with variable ontologies. Power is related to capacity to define the order of worth. "Each speech act produces a situation, it is by itself an attempt to impose a structure" (Cooren, 2000: 189). Communicative action is seen as an attempt to impose the structure of the network of rules, thus to influence the exchange of values. This structure will constrain future action conducted by other entities in the networks, since cultural rules "channel" the functioning of the network. In any case, organization can emerge only if the actors "share an interpretation of what a rule means before they apply it"

(Tsoukas, 2000: 109), or negotiate it. Basically, the three networks, actants, emergent concepts and rules, cannot evolve without each other: their existence (emergence) is relational.

Conclusion

The multi-dimensional network metaphor provides an explanation for how material and immaterial layers co-evolve in the organizing process. The material network of actants is related to a cognitive network and a network of rules. Networks can be seen as physical settings, or as abstract matrixes. They maintain themselves and evolve at the same time. Changes in one network cascade into changes in the others (Carley, 2003). The result is the continuous structuration process of inter-linked entities with variable ontologies in the meta-network. Texts and conversations turn out to be not opposite, but complementary views of the organization (Taylor and Van Every, 2000). Thanks to the meta-matrix metaphor, structural and material properties of material entities can be linked to the latent properties of actor-networks. "Cultural systems, as linguistically mediated, symbolic constellations, have many of the same dissipative traits as the human communities that produced them. There is nothing in a materialist, dissipative systems paradigm, then, to prevent us from dealing forthrightly with cultural phenomena" (Harvey and Reed, 1996: 306). This paper should be seen as a preliminary essay. Numerous points are open to debate. The article shows that materialist assumptions should not be confounded with Newtonian assumptions. However, the main question is how such a metaphorical framework could be operationalized. A part of the framework presented in this paper could be compared to other holistic explanations, e.g. the CMM Theory (Cronen *et al.*, 1982). If the framework cannot be operationalized, questions are raised about its validity. In order for our framework to be operationalized, the system of rules should be studied with deeper insight, evolutive links between conversational rules and narrative rules should be analyzed and the distribution of cultural values should be examined.

References

Agostinelli, S. (2003). *Les nouveaux outils de communication des savoirs*. Paris: L'Harmattan

Argyris, C., and Schön, D. (1978). *Organizational Learning: A Theory of Action Perspective*. Reading, Mass: Addison Wesley

Berger, P.L., and Luckman, T. (1966). *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. New York : Doubleday

Barabasi, A.L. (2002). *Linked: The New Science of Networks*. Cambridge: Perseus.

Boi, L. (1998). Réflexions épistémologiques et historiques sur la géométrisation de la physique et la nature de l'espace-temps. Retrieved at: http://www.philo.umontreal.ca/textes/Boi.pdf

Boje, D. M.(2007). Why Storytelling Dialogism Yields Emergence ? Retrieved at http://business.nmsu.edu/~dboje/690/book/CHAPTER%202%20dialogicality%20jan%2017%2006%20boje.doc

Boltanski, L., and Thévenot, L. (1991). *De la justification. Les économies de la grandeur*. Paris : Gallimard

Boulding, K. (1956). General System Theory -- The Skeleton of Science. *General Systems*, 1: 11-17.

Bourdieu, P. (1980). *Le sens pratique*. Paris : Editions de Minuit

Bourdieu, P. (1979). *La distinction*. Paris : Editions de Minuit

Brass, D.J., and al. (2004). Taking Stock of Networks and Organizations: A Multilevel Perspective. *Academy of Management Journal*, 47 (6): 795-817

Byrne D. (1998). *Complexity and the Social Sciences, An Introduction*. London : Routledge

Callon, M., and Latour, B. (2006). Le grand Léviathan s'apprivoise-t-il ? In M. Akrich, M. Callon, and B. Latour : *Sociologie de la traduction : textes fondateurs*. Paris : Presses de Mines Paris.

Campbell-Hunt, C. (2007). Complexity in practice. *Human Relations*, 60 (5): 793-823

Carley, K. (2006). Dynamic Network Analysis for Counter-Terrorism. Conference « The Age of Networks », University of Illinois at Urbana-Champaign. Retrieved at : http://www.spcomm.uiuc.edu/TECLAB/aon/CarleyPaper.pdf>

Carley, K. (2003). Dynamic Network Analysis. In R. Breiger, K. Carley, and P. Pattison (Eds.), *Dynamic Social Network Modeling and Analysis : Workshop Summary and Papers*, National Research Council : 133-145

Chia, R. (1997). Essai: Thirty Years On: From Organizational Structures to the Organization of Thought. *Organization Studies*, 18 (4): 685-707

Cooren, F. (2006). The Organizational World as a Plenum of Agencies. In F. Cooren, J. Taylor and J. Van Every (Eds.), *Communicating as Organizing*. Mahwah : L. Erlbaum: 81-100

Cooren, F., Taylor, J., and Van Every, J. (2006). Introduction. In F. Cooren, J. Taylor and J. Van Every (Eds.), *Communicating as Organizing*. Mahwah : L. Erlbaum: 1-16

Cooren, F. (2000). *The Organizing Property of Communication*. Amsterdam: John Benjamins

Corman, S.R., *et al*. (2002). Studying Complex Discursive Systems, Centering Resonance Analysis in Communication. *Human Communication Research*, 28 (2) : 157-206

Cronen, V.E., Pearce, E.B., and Harris, L.M. (1982). The Coordinated Management of Meaning: A Theory of Communication. In F.E.X. Dance (Ed.). *Human Communication Theory*, New York: Harper and Row: 61-89

Dooley, K.J., and Van de Ven, A.H. (1999). Explaining Complex Organizational Dynamics. *Organization Science*, 10 (3): 358-372

Friedberg, E. (1993). *Le pouvoir et la règle, dynamiques de l'action organisée*. Paris : Seuil

Giddens, A. (1984). *La constitution de la société*. Paris : PUF

Giddens, A. (1979). *Central Problems in Social Theory*. 2nd edition, 1994, Berkeley: University of California Press.
Goffman, E. (1974). *Frame Analysis*. New York : Harper and Row
Goldstein, J. (1999). Emergence as a Construct: History and Issues. *Emergence*, 1 (1) : 49-72
Green, D.G. (2000). Self-organization in Complex Systems. In T.R.J. Bossomaier, and D.G. Green, (Eds.). *Complex systems*. Cambridge: Cambridge University Press: 11-48
Harris, L. M., and Cronen, V.E. (1979). A Rule-Based Model for the Analysis and Evaluation of Organizational Communication. *Communication Quaterly*, 27:12-28
Harvey, M., and Reed, D.L. (1996). Social Science as the Study of Complex Systems. In L.D. Kiel and E.W. Elliot, *Chaos Theory in the Social Sciences: Foundations and Application*, Ann Harbor: University of Michigan Press : 295-323
Hutchins, E. (1991). Organizing Work by Adaptation. *Organization Science*, 2 : 14-39
Kauffman, S. (1995). *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity*. Oxford: Oxford University Press
Kristeva, J. (2002). "Nous Deux" or a (Hi)story of Intertextuality. *Romanic Review*, Jan-Mar. Retrieved at: http://findarticles.com/p/articles/mi_qa3806/is_/ai_n9036400
Kroeber, A., and Kluckhohn, C. (1952) *Culture.* New York: Meridian Books.
Lambert, D. (1999). Symétrie formelle, mathématiques profondes et réalité. In Y. Sacquin, G. Cohen-Tannoudji (dir.), *Symétrie et brisure de symétrie***,** Paris : EDP, 31-50
Latour, B. (2005). *Reassembling the Social: an Introduction to Actor-Network-Theory*. Oxford: Oxford University Press
Latour, B. (1996). On Interobjectivity. *Mind, Culture and Activity*, 3 (4): 228-245
Latour, B. (1991). *Nous n'avons jamais été modernes; essai d'anthropologie symétrique*. Paris: La Découverte
Lave, J. (1988). *Cognition in Practice: Mind, Mathematics, and Culture in Everyday life*. Cambridge: Cambridge University Press.
Lissack, M.R., and Roos, J. (2007). Words Count : Viewing Organizations As Emerging Systems of Languaging. Working Paper, submitted to *The Academy of Management Journal*. Retrieved at: www.lissack.com/writings/AMRfinal.pdf
Lochak, G. (1994). La géométrisation de la physique. Paris : Flammarion
Luhman, J.T., and Boje, D.M. (2001). What is Complexity Science? A Possible Answer from Narrative Research. *Emergence: Complexity and Organization*, 3 (1): 158-168
MacArthur, *et al*. (2007). On Automorphism Groups of Networks. Working Paper. Retrieved at http://arxiv.org/abs/0705.3215
Mandelbrot, B. (1984). *Les objets fractals*. Paris : Flammarion
McKelvey, B. (2001). What is Complexity Science? It is Really Order-Creation Science. *Emergence: Complexity and Organization*, 3 (1): 137-157
Miller, K. (1998). Nurses at the Edge of Chaos. The Application of "New Science" Concepts to Organizational Systems. *Management Communication Quarterly*, 12 (1): 112-127
Moody, J., McFarland, D., and Bender-deMoll, S. (2005). Dynamic Network Visualization. *American Journal of Sociology*, 110 (4): 1206-41
Monge, P.R., and Contractor, N.S. (2001). Emergence of Communication Networks. In F.M. Jablin, and L.L. Putnam (Eds.) *The New Handbook of Organizational Communication, Advances in Theory, Research and Methods*, London : Sage, 2001 : 441-502
Morçöl G. (2001). What is Complexity Science? Postmodernist or Postpositivist?. *Emergence: Complexity and Organization*. 3(1): 104-119
Morel, B., and Ramanujam, R. (1999). Through the Looking Glass of Complexity: The Dynamics of Organizations as Adaptative and Evolving Systems. *Organization Science*, 10 (3): 278-293

Morgan, G. (1980). Paradigms, Metaphors and Problem Solving in Organization Theory. *Administrative Science Quarterly*, 25 : 605-622

Morin, E. (1986). *La Méthode 3 - La connaissance de la connaissance*. Paris : Seuil

Morin E. (1977). *La Méthode, 1. La nature de la nature*. Paris : Seuil

Nicolics, H. (2008). Quantum Mechanics : Myths and Facts. Working Paper. Retrieved at: http://arxiv.org/PS_cache/quant-ph/pdf/0609/0609163v2.pdf

Pollack, J. B. (1989). Connectionism: Past, Present, and Future. *Artificial Intelligence Review*, 3 : 3-20.

Prigogine, I. (1997). *The End of Certainty*. New York : Free Press

Richardson, K.A., Cilliers, P., and Lissack, M. (2001). Complexity Science : A « Gray » Science for the « Stuff in Between ». *Emergence: Complexity and Organization*, 3 (2): 6-18

Richardson K., and Cilliers P. (2001). What is Complexity Science? A View from Different Directions. *Emergence: Complexity and Organization*. 3(1): 5-23

Robichaud, D. (2006). Steps Toward A Relational View of Agency. In F. Cooren, J. Taylor and J.Van Every (Eds.), *Communicating as Organizing*. Mahwah : L. Erlbaum: 101-114

Scott, J. (2000). *Social Networks Analysis*. 2nd Edition, London : Sage

Searle, J.R. (1972). *Les actes de langage*. Paris: Hermann

Seeley, D.A. (2000). Network Evolution and the Emergence of Structure. In T.R.J. Bossomaier, and D.T. Green (Eds.) *Complex systems*, Cambridge: Cambridge University, 2000: 51-89

Sigman, S.J. (1980). On Communication Rules from a Social Perspective. *Human Communication Research*, 7 (1) : 37-51

Simon, H. (2005). The Architecture of Complexity. (reprinted) *Emergence*, 7 (34): 138-154

Stacey, R.D. (2001). *Complex Responsive Processes in Organizations, Learning and Knowledge Creation*. London : Routledge.

Stacey, R.D., Griffin, D., and Shaw, P. (2000). *Complexity and Management*. London: Routledge

Taylor, J. (2006). Coorientation : a Conceptual Framework. In F. Cooren, J. Taylor and J.Van Every (Eds.), *Communicating as Organizing*. Mahwah : L. Erlbaum: 141-156

Taylor, J.R., and Van Every, E.J. (2000). *The Emergent Organization: Communication As its Site and Surface*, Mahwah : Erlbaum

Taylor, J.R., *et al.* (1996). The Communicational Basis of Organization : Between the Conversation and the Text. *Communication Theory*, 6 (1): 1-39

Tsoukas, H. (2000). Knowledge as Action, Organization as Theory. *Emergence: Complexity and Organization*, 2 (4). 104-112

Tsoukas, H. (1993). Analogical Reasoning and Knowledge Generation in Organization Theory. *Organization Studies*, 14 (3): 323-346

Tsoukas, H., and Chia, R. (2002). On Organizational Becoming : Rethinking Organizational Change. *Organization Science*, 13 (5): 567-582

Tsoukas, H., and Hatch, M.J. (2001). Complex Thinking, Complex Practice: The Case for a Narrative Approach to Organizational Complexity. *Human Relations*, 34 (8): 979-1013

Watts, D.J. (2004). The "New" Science of Networks. *Annual Review of Sociology*, 30: 243-70

Watts, D.J., and Strogatz, S.H. (1998). Collective Dynamics of 'Small-World' Networks. *Nature*, 393: 440-442

Weick, K. E. (1995). *Sensemaking in Organizations*. Newbury Park: Sage

Weick, K.E. (1979). *The Social Psychology of Organizing*. New York : Mc Graw Hill